Claims

1	1. A user connection element for a force reflecting haptic interface, the user connection
2	element comprising a presence detector comprising:
3	(i) an electrically conductive portion for contacting a user;
4	(ii) an electrical circuit; and
5	(ni) a connector for electrically coupling the conductive portion with the electrical
6	circuit.
1	2. The user connection element of claim 1, wherein the user connection element is a stylus.
1	3. The user connection element of claim 1, wherein the electrically conductive portion
2	comprises a conductive rubber.
1	4. The user connection element of claim 1, wherein the electrically conductive portion
2	envelops substantially an entire external surface of the user connection element.
1	5. The user connection element of claim 2, wherein the electrically conductive portion
2	extends along an axial and circumferential portion of an external surface of the stylus.
2 1 2	The user connection element of claim 1, wherein the connector comprises a spring
2	contact which is biased against an interior surface of the electrically conductive portion.
2	7. The user connection element of claim 1, wherein the electrical circuit detects a change in
2	capacitance relative to ground due to contact by a user.
	8. The user connection element of claim 1, wherein the electrical circuit comprises:
2	an oscillator for generating a signal;
3	a signal divider for receiving the signal and generating a first and a second pulse;
4	a phase detector for receiving the first pulse; and
5	a variable delay for receiving the second pulse and including an input terminal
6	electrically coupled to the electrically conductive portion, wherein the variable delay delays the
7	second pulse an amount of time before reaching the phase detector when a user is contacting the
8	electrically conductive portion.
1	9. The user connection element of claim 8, wherein the amount of time of the delay depends

2

on the change in capacitance.

- The user connection element of claim 8, wherein the user connection element outputs a 1
- signal to enable operation of the haptic interface. 2
- Thauser connection element of claim 1, wherein the variable delay includes a surge 11. 1
- protector. 2
- 12. A wrist rest for a haptic interface, the wrist rest comprising a pad including a contact 1
- surface to support an arm or a wrist of a user. 2
- 13. The wrist rest of claim 12, wherein the contact surface is substantially planar. 1
- The wrist rest of claim 12, wherein the contact pad is concave. 14. 1
- 1 15. The wrist rest of claim \(\frac{1}{2}\), wherein the pad further comprises a gel material encased in a
- covering material. 2
 - The wrist rest of claim 15, wherein the gel is a soft silicone gel. 16.
 - The wrist rest of claim 15, wherein the covering material is selected from the group 17. consisting of a natural fabric and a synthetic fabric.
 - 18. The wrist rest of claim 12, wherein a height and an orientation of the wrist rest is adjustable to accommodate various user interface elements.
 - A velocity limiting control method for a haptic interface with powered axes, the velocity 19. limiting method comprising the steps of:

measuring the rotational speed of an actuator; and slowing the actuator when a predetermined maximum actuator speed is exceeded.

- 20. The velocity limiting control method of claim 19 further comprising the step of 1
- determining a maximum actuator speed. 2
- The velocity limiting control method of claim 19, wherein the slowing step comprises 1 21.
- dynamically braking the actuator. 2
- 22. The velocity limiting control method of claim 21, wherein the actuator is a Domotor and
- the step of dynamically braking the actuator is achieved by shunting leads of the DC motor.



1

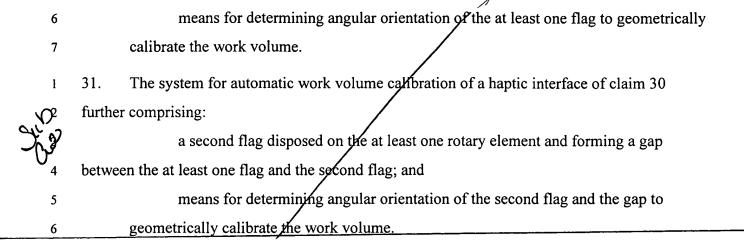
₽ 2

111 ٠. أ

. . 12

3

.0	1	23. The velocity limiting control method of claim 19, wherein the slowing step comprises
M/	2	disabling the actuator.
	1	24. An automatic work volume calibration method for use with a haptic interface, the
	m	calibration method comprising the steps of:
5		initializing a position of the haptic interface; and
,	4	geometrically centering a user reference point in a workspace volume and a
	5	remote environment
	1	25. An automatic work volume calibration method for use with a haptic interface, the
	2	calibration method comprising the steps of:
	3	rotating a rotary element of the haptic interface;
	4	tracking an angular orientation of the rotary element;
de de la companya de	5	determining a home position for the rotary element; and
į	6	centering a user reference point by comparing the angular orientation of the rotary
	6	element with respect to the home position of the rotary element.
	ing 1	26. The automatic work volume calibration method of claim 25, wherein an encoder is used
÷	2	to track the angular orientation and determine the home position of the rotary element.
ii Q		27. The automatic work volume calibration method of claim 25, wherein a proximity switch
1	- 2	is used to track the angular orientation and determine the home position of the rotary element.
		28. The automatic work volume calibration method of claim 25, wherein a microswitch is
Cu	ا ارم	used to track the angular orientation and determine the home position of the rotary element.
7	J'A	29. The automatic work volume calibration method of claim 25, wherein a potentiometer is
	2	used to track the angular orientation and determine the home position of the rotary element.
	1	30. A system for automatic work volume calibration of a haptic interface, comprising:
	2	at least one rotary element;
	3	at least one flag disposed on the at least one rotary element;
	4	a user interface connection for moving the at least one rotary element through a
	5	range of motion thereof; and



age of the contract of the con